United States Department of the Interior

FISH AND WILDLIFE SERVICE
Illinois & Iowa ES Field Office
1511 47th Avenue
Moline, Illinois 61265
Phone: (309) 757-5800 Fax: (309) 757-5807

IN REPLY REFER TO:

Biological Opinion

for

Hoopeston Wind Project Habitat Conservation Plan and Incidental Take Permit, Vermilion County, Illinois

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Prepared by:
U.S. Fish and Wildlife Service
Illinois-Iowa Ecological Services Field Office
Moline, Illinois

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Kraig McPeek, Field Supervisor
Illinois - Iowa ES Field Office

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Summary

This document transmits the biological opinion of the Fish and Wildlife Service (Service) prepared under the authority of and in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.). This opinion is based on information provided in the September 2017 Final Habitat Conservation Plan for the Indiana Bat and the Northern Long Eared Bat (HCP), the September 2017 Final Environmental Assessment for the Proposed Habitat Conservation Plan and Incidental Take Permit (EA), the 2014 Bird and Bat Conservation Strategy (BBCS), and other literature and data sources, as cited herein.

This biological opinion evaluates the Service's issuance of an incidental take permit (pursuant to section 10 of the Act), as the issuance of this permit is considered a federal action requiring consultation under section 7 of the Act. It evaluates the potential direct and indirect effects to Indiana bats and northern long-eared bats that may occur as a result of implementing the covered activities as described in the associated HCP. Furthermore, this opinion only assesses impacts to federally listed species and does not address the overall environmental acceptability of the proposed action. The purpose of formal section 7 consultation is to ensure that any action authorized, funded, or carried out by the federal government is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat of the species.

The activities covered under the HCP developed for the Hoopeston Wind Project (HWP) may incidentally cause take of the federally endangered Indiana bat and threatened northern long-eared bat. The Service has determined in this opinion that the activities described in the Habitat Conservation Plan will not jeopardize the continued existence of the Indiana bat or the northern long-eared bat. On January 14, 2016, the Service published a species-specific rule pursuant to section 4(d) of the ESA for the northern long-eared bat. Under that rule, take of northern long-eared bats outside of hibernacula resulting from activities other than tree removal is not prohibited. The incidental take that may occur due to implementation of the HWP would all occur outside of hibernacula and would not involve tree removal. Therefore, the incidental take would not be prohibited and does not require exemption in the Incidental Take Statement (ITS). Nevertheless, to account for the possibility that the 4(d) rule may not remain in effect through the life of the HWP, we describe in the ITS the extent of northern long eared bat incidental take that we anticipate and apply reasonable and prudent measures and terms and conditions to both covered bat species. This is consistent with the change in adaptive management triggers described in the HCP that would occur if the 4(d) rule is no longer in effect (see section 8.1.2.5 of the HCP.) The eastern prairie fringed orchid (*Platanthera leucophaea*), clubshell (*Pleurobema clava*), and rabbitsfoot (*Quadrula cylindrical cylindrical*) are also listed as threatened and endangered for Vermillion County, respectively, but this action is not expected to affect these species.

Consultation History

This section 7 analysis was triggered by the submission of the Draft Final HCP in January, 2017 and its subsequent publication in the Federal Register on March 9, 2017. The comment period closed on April 10, 2017. The HCP was developed in coordination with the Illinois and Iowa Ecological Services Field Office between 2014 and 2017.

1. Description of the Proposed Action

The Service received an application for an Incidental Take Permit (ITP), pursuant to the provisions of section 10(a)(1)(B) of the Endangered Species Act of 1973, as amended (ESA;16 United States Code [USC] §§ 1531–1544.) for the Hoopeston Wind Energy Project (HWP or Project). The ITP would authorize the incidental take of the federally endangered Indiana bat (*Myotis sodalis*), and the federally threatened northern long-eared bat (*Myotis septentrionalis*) during operation of the HWP in Vermillion County, Illinois (see HCP for site location details). Under section 10 of the ESA, applicants may be authorized, through issuance of an ITP, to conduct activities that may result in take of a listed species as long as the take is incidental to, and not the purpose of, otherwise lawful activities.

The HWP is a wind energy facility with a nameplate capacity of 98-megawatts (MW) and comprises 49 2.0-MW wind turbine generators, an operations and maintenance building, access roads, collector line system, and substation. The project site consists of approximately 8,884 acres of gently rolling and open farmland, where corn and soybeans dominate the landscape. Of those 8,884 acres, 25 have been permanently removed from crop production and utilized for the HWP.

The project is currently operating under the provisions of the Bird and Bat Conservation Strategy for Hoopeston Wind Energy Project (BBCS) and a technical assistance letter (TAL) issued by the Service in July of 2017. The BBCS and TAL calls for several wildlife conservation measures, including:

1) Fully feathering blades at individual turbines at wind speeds less than 11.2 mph (5.0 m/s) from sunrise to sunset beginning August 1 to October 15.
2) Having turbines sited 1,000 feet from potential Indiana and northern long-eared bat habitat.
3) Having curtailed turbines be fully feathered.
4) Curtailing on an individual basis, based on rolling wind speed and temperature averages over 15-min periods, as follows:
    a. A turbine operates if the average wind speed at that turbine over a 15-min period exceeds 11.2 mph (5.0 m/s).
    b. Turbine blades are feathered if the average wind speed at that turbine over a 15-min period is less than 11.2 mph (5.0m/s).

Under the Preferred Alternative put forth in the HCP, the Service would issue a 30-year ITP that would authorize incidental take of Indiana bats and northern long-eared bats associated with the operation of 49 turbines. HWP would implement an HCP that includes:

1) Operational measures to reduce take of listed bats: 3.0 m/s cut-in speed from sunset to sunrise when the ambient temperature is above 10°C from March 15 through October 15;
2) Off-site conservation measures to mitigate the impact of taking Indiana bats and northern long-eared bats that cannot be avoided; and
3) Intensely monitoring and incorporating an adaptive management plan to measure the effectiveness of reducing bat mortality during turbine operations. Adaptive management of operations will include raising operational cut-in speeds according to results from the intense mortality-monitoring regime (see Sections 7.4 and 7.3 in the Project HCP).

1.1 Conservation Measures

The biological goals identified in the HCP are to reduce impacts to listed species (i.e. Indiana bat and northern long-eared bat) to the maximum extent practicable. HWP would use best available science, which suggests that a 35 percent take reduction can be attained using turbine operational protocols including raised cut-in speeds and blade feathering (see Section 7.0 in the Project HCP).

These goals will be achieved through the implementation of conservation measures designed to avoid, minimize, monitor, and mitigate impacts of the proposed action on Indiana bats and northern long-eared bats. The Service has analyzed the effects of the proposed action based on the assumption that all conservation measures will be implemented. A more detailed description of the project's conservation measures can be found in Section 7.2 of the HCP, but they are summarized briefly here. Note that the applicant implemented additional avoidance and minimization measures during project construction that are detailed in the BBCS.

1) Minimization Measures

- HWP proposes to feather turbines below the manufacture's cut-in speed (3.0 m/s) during the spring (March 15 to May 15), summer (May 16 to July 31) and fall (August 1 to October 15) periods. HWP selected this minimization measure because research suggest that feathering below manufacture's cut-in speed may reduce fatalities by 35 to 57.5 percent (Baerwald et al. 2009, Young et al. 2011, Good et al. 2012).

2) Mitigation Measures

- Activities for preservation or restoration may include tree plantings , herbaceous cover crop, mowing around trees to reduce competition and impede weed growth, stand thinning, girding to provide roost trees, understory plantings, invasive species control, prescribed fire, selective harvesting, and/or supplemental plantings (see Section 7.2.2 and Appendix B of the HCP).

3) Mortality Monitoring

- Following the issuance of the incidental take permit, HWP will conduct three years of intense monitoring which will include carcass searches of 90 percent roads and pads and 10 percent full plots (80x80 m) once a week in the spring (April 1 through May 15). In the fall (August 1 through October 15), monitoring will include 70 percent roads and pads and 30 percent full plots (80x80 m).
- The Project's intense monitoring regime consist of an overall detection probability of 0.301 and a 90 percent confidence level that six or fewer Indiana and/or northern long-eared bats were not taken in the initial three years of monitoring.
- Follow-up monitoring in years 15 and 16 will mirror the first three years of intense monitoring, which will include spring and fall carcass searches.
- Monitoring results will include corrections for carcass removal, searcher efficiency, and searchable area. Also, annual reports following the completion of each year of post-construction monitoring will be provided to the Service. However, should a listed species be found during monitoring, the Service will be notified within 48 hours of discovery and identification.
- A report with the results and conclusions of the mortality monitoring will be submitted to the Service following the completion of each year of monitoring. The report will include: 1) cumulative and annual assessment of take; 2) an assessment of the effectiveness of the conservation plan; 3) status of the mitigation project; 4) if applicable, recommendations for future research, monitoring, and mitigation; 5) a list of any changed circumstances that apply and strategies to address them; 6) written confirmation that funding is available or committed for the full implementation of the HCP for the ensuing year; and 7) a summary of any adaptive management measures that have been or will be implemented

2. Status of the Species

This section presents biological or ecological information relevant to formulating this Biological Opinion. Appropriate information on species' life history, habitat and distribution, and other data on factors necessary to survival are included to provide background for analysis in later sections. This analysis documents the effects of past human and natural activities or events that have led to the current range-wide status of the species. Portions of this information are also presented in listing documents, the recovery plan (USFWS 1983), and the draft revised recovery plans (USFWS 1999 and USFWS 2007), and are referenced accordingly.

2.1 Species Description

Indiana bat

The Indiana bat is an insectivorous, temperate, medium-sized bat that migrates annually from winter hibernacula to summer habitat in forested areas. The bat has a head and body length that ranges from 41 to 49 mm, with a forearm length of 35 to 41 mm. The fur is described as dull pinkish-brown on the back but somewhat lighter on the chest and belly, and the ears and wing membranes do not contrast with the fur (Barbour and Davis 1969). Although the bat resembles the little brown bat and the northern long-eared bat, it is distinguished by its distinctly keeled calcar and a long, pointed, symmetrical tragus.

Northern long-eared bat

The northern long-eared bat is a medium-sized bat with an average adult weight of 5 to 8 grams, average body length from 77 to 95 millimeters, and forearm length between 34 and 38 millimeters (Caceres and Pybus 1997). Its fur ranges from medium to dark brown on the dorsal side, and tawny to pale-brown on the ventral side, with dark brown ears and wing membranes. As indicated by its common name, the northern long-eared bat is distinguished from other Myotis species by its relatively long ears (average 17 mm (0.7 in)) (Whitaker and Mumford 2009) that, when laid forward, extend beyond the nose up to 5 mm (0.2 in) (Caceres and Barclay 2000). Within its range, the northern long-eared is sometimes confused with the little brown bat (*Myotis lucifugus*) or the western long-eared myotis (*Myotis evotis*). The northern long-eared bat is distinguished from the little brown bat by its longer ears, tapered and symmetrical tragus, slightly longer tail, and less glossy pelage (Caceres and Barclay 2000), and from the western long-eared myotis by its darker pelage and paler membranes (Caceres and Barclay 2000).

2.2 Diet and Foraging

Indiana Bat

Indiana bats forage over a variety of habitat types but prefer to forage in and around the tree canopy of both upland and bottomland forest or along the corridors of small streams. Bats forage at a height of approximately 2-30 meters under riparian and floodplain trees (Humphrey et al. 1977). They forage between dusk and dawn and feed exclusively on flying insects, primarily moths, beetles, and aquatic insects. Females in Illinois were found to forage most frequently in areas with canopy cover of greater than 80%, and typically utilize larger foraging ranges than males (Garner and Gardner 1992).

Northern long-eared bat

The northern long-eared bat forages on a variety of insect types and does so primarily above the understory, but under the canopy in forested habitats (Nagorsen and Brigham 1993). It is capable of both capturing prey in midair and gleaning perched insects from surfaces. This gleaning ability, combined with agile flight capabilities, enables the northern long-eared bats to forage in dense forests with heavy understory (Foster and Kurta 1999). The northern long-eared bat has shown a preference for forested hillsides and ridges over riparian areas (Brack and Whitaker 2001; LaVal et al. 1977) and other data indicates that mature forests are important foraging habitat for the northern long-eared bat (Caceres and Pybus 1997). It is estimated that the northern long-eared bat has a home range of 47 to 425 acres (Lacki et al 2009), with an average maternal home range of approximately 160 acres (Owen et al. 2003).

In general, the northern long-eared bat consumes moths, flies, leafhoppers, caddisflies, and beetles. However, the most common insects found in the diet of the northern long-eared bat are moths and beetles (Feldhammer et al. 2009; Brack and Whitaker 2001). The northern long-eared bat's foraging patterns include a peak activity period within five hours of sunset, and a second peak within eight hours of sunset (Kunz 1973). Insects consumed during these periods do not seem to be significantly different (Brack and Whitaker 2001).

2.3 Summer Habitat and Home Range

Indiana Bat

Female Indiana bats emerge from hibernation ahead of males; most winter populations leave by early May. Some males spend the summer near hibernacula in Missouri (LaVal and LaVal 1980) and West Virginia (Stihler, pers. observ. October 1996, in USFWS 2000). In spring when fat reserves and food supplies are low, migration is probably hazardous (Tuttle and Stevenson 1977). Consequently, mortality may be higher in the early spring, immediately following emergence.

Females may arrive in their summer habitats as early as April 15 in Illinois (Gardner et al. 1991, Brack 1979). During this early spring period, a number of roosts (e.g., small cavities) may be used temporarily, until a roost with larger numbers of bats is established. Humphrey et al. (1977) reported that Indiana bats first arrived at their maternity roost in early May in Indiana, with substantial numbers arriving in mid-May. Birth of young occurs in late June and early July (Easterla and Watkins 1969, Humphrey et al. 1977) and the young are able to fly between mid-July and early August (Mumford and Cope 1958, Cope et al. 1974, Humphrey et al. 1977, Clark et al. 1987, Gardner et al. 1991a, Kurta et al. 1996). Female Indiana bats exhibit strong site fidelity to summer roosting and foraging areas. That is, they return to the same summer range annually to bear their young (Garner and Gardner 1992).

In general, Indiana bats roost in large, often dead or partially dead trees with exfoliating bark and/or cavities and crevices (Callahan et al. 1997; Farmer et al. 2002; Kurta et al. 2002). Trees in excess of 16 inch diameter at breast height (dbh) with exfoliating bark are considered optimal for maternity colony roost sites, but trees in excess of 9 inch dbh appear to provide suitable maternity roosting habitat (Romme et al. 1995). Indiana bat maternity roosts can be described as primary or alternate based upon the proportion of bats in a colony consistently occupying the roost site. Maternity colonies typically use 10 to 20 trees each year, but only one to three of these are primary roosts used by the majority of bats for some or all of the summer (Garner and Gardner 1992). Alternate roosts are used by individuals, or a small number of bats, and may be used intermittently throughout the summer or used on only one or a few days. Females frequently switch roosts to find optimal roosting conditions, switching roosts every few days on average. The reproductive condition of the female, roost type, and time of year affect switching. When switching between day roosts, Indiana bats may travel as little as 23 feet (7 m) or as far as 3.6 miles (5.8 km) (Kurta et al. 1996; Kurta et al. 2002). In general, moves are relatively short and typically less than 0.6 mile (1 km) (USFWS 1997).

The range of maternity colony sizes observed for the Indiana bat is 10-100 adult females (Kurta and Rice 2002), and 60 females is the average of the overall variability in maternity colony size. The home range of a maternity colony is the area within a 2.5-mile radius (i.e., 12,560 acres) around documented roosts or within a 5-mile radius (i.e., 50,265 acres) around capture location of a reproductive female or juvenile Indiana bat or a positive identification of Indiana bat from properly deployed acoustic devices. Based on data provided in the Indiana bat draft revised Recovery Plan (USFWS 2007), a maternity colony needs at least 10% suitable habitat (i.e., forested habitat) to exist at a given point on the landscape.

After the summer maternity period, Indiana bats migrate back to traditional winter hibernacula. Some male bats may begin to arrive at hibernacula as early as July. Females typically arrive later and by September the number of males and females is almost equal. Autumn "swarming" occurs prior to hibernation. During swarming, bats fly in and out of cave entrances from dusk to dawn, while relatively few roost in the caves during the day. By late September many females have entered hibernation, but males may continue swarming well into October in what is believed to be an attempt to breed with late arriving females. Swarming behavior is further described below in Section 2.4

Male Indiana bats may be found throughout the entire range of the species. Males appear to roost singly or in small groups, except during brief summer visits to hibernacula. Males have been observed roosting in trees as small as 3 inches dbh.

Northern long-eared bat

During the summer, the northern long-eared bat occupies forested habitat and roosts (singly or in colonies) in the cracks, crevices, and bark of both live and dead trees (Lacki and Schwierjohann 2001), but they also have been found to roost in human made structures, such as buildings, barns, sheds, cabins, etc. Also, it appears that the northern long-eared bat does not depend on any specific species of tree, but rather the tree characteristics and/or tree decay structure are the most important factors in roost selection (Foster and Kurta 1999). The northern long-eared bat has been found to roost below the canopy in forests with a variety of canopy cover percentages, but research has indicated that females do tend to roost in more open areas than males (Perry and Thill 2007). Open areas receive greater solar insolation, which increases roost temperature and therefore pup development.

Northern long-eared bats exhibit site fidelity to their summer forested habitats (Perry 2011; Johnson et al. 2009a; Jackson 2004; Foster and Kurta 1999). Summer home range includes both roosting and foraging areas, and home range size may vary by sex. Broders et al. (2006) found the maternity roosting area and foraging area of females (mean of 8.6 ha (21.3 acres) and 46.2 ha (114.2 acres), respectively) larger than males (mean of 1.4 ha (3.5 acres) and 13.5 ha (33.4 acres)), but Lereculeur (2013) found no difference between sexes at a study site in Tennessee. Broders et al. (2006) and Henderson and Broders (2008) found the foraging areas of either sex were six or more times larger than roosting areas. At sites in the Red River Gorge area of the Daniel Boone National Forest, Lacki et al. (2009b) found female home range size to range from 19 to 172 ha (47 to 425 acres). Owen et al. (2003) estimated average maternal home range size at 65 ha (161 acres).

The mean distance between roost trees and foraging areas of radio-tagged individuals in New Hampshire was 602 m (1,975 ft) with a range of 60 to 1,719 m (197 to 5,640 ft) (Sasse and Pekins 1996). Henderson and Broders (2008) found that female northern long-eared bats on Prince Edward Island traveled approximately 1,100 m (3,609 ft) between maternity roosting and foraging areas. In New Brunswick, Broders et al. (2006) reported the mean distance between the centers of maternity roosting areas and foraging areas as 584.6 m (1,918.0 ft) for females and 405.8 m (1,331.4 ft) for males.

Roosts trees are often in fairly close proximity to each other. In Missouri, Timpone et al. (2010) radio-tracked 13 northern long-eared bats to 39 roosts and found the mean distance traveled between roost trees was 0.67 km (0.42 mi) (range 0.05–3.9 km (0.03–2.4 mi)). In Michigan, the longest distance moved by the same bat between roosts was 2 km (1.2 mi), and the shortest was 6 m (20 ft) (Foster and Kurta 1999). In the Ouachita Mountains of Arkansas, Perry and Thill (2007) found that individuals moved among snags distributed in an area of about 2 ha (5 acres). Johnson et al. (2011) found that northern long-eared bats form social groups in networks of roost trees centered on a central-node roost, which may function like a primary maternity roost tree for an Indiana bat colony (i.e., locations for social behavior, thermal buffering), but were identified in this study by the degree of connectivity with other maternity roost trees rather than by the number of individuals using the tree.

Males and females generally roost separately (Caceres and Barclay 2000), and some studies cited above suggest differences in summer home range size between males and females. Despite these differences, males and females may share a large fraction of their foraging habitat within the occupied forested landscape. An analysis of mist net survey data in Kentucky (Service 2014, unpublished data cited in the final listing rule) shows that most males and non-reproductive females are captured in the same locations as reproductively active females (1,712 of 1,825 capture records or 94 percent), suggesting substantial overlap in the summer home range of reproductive females and other individuals.

Maternity colonies, consisting of females and young, are generally small, numbering from about 30 (Whitaker and Mumford 2009, p. 212) to 60 individuals (Caceres and Barclay 2000, p. 3); however, one group of 100 adult females was observed in Vermilion County, Indiana (Whitaker and Mumford 2009, p. 212). In West Virginia, maternity colonies in two studies had a range of 7 to 88 individuals (Owen *et al.* 2002, p. 2) and 11 to 65 individuals, with a mean size of 31 (Menzel *et al.* 2002, p. 110). Lacki and Schwierjohann (2001, p. 485) found that the number of bats within a given roost declined as the summer progressed. Pregnant females formed the largest aggregations (mean=26) and post-lactating females formed the smallest aggregation (mean=4). The largest reported colony size was 65 bats. Other studies have also found that the number of individuals roosting together in a given roost typically decreases from pregnancy to post-lactation (Foster and Kurta 1999, p. 667; Lacki and Schwierjohann 2001, p. 485; Garroway and Broders 2007, p. 962; Perry and Thill 2007, p. 224; Johnson *et al.* 2012, p. 227).

2.4 Migration, Swarming, and Winter Habitat

<u>Migration Routes of Indiana bats and Northern long-eared bats</u>

A 2011 spring migration study at the Blackball Mine hibernacula in Illinois documented that the majority of tagged Indiana bats emerging from Blackball travelled south and west down the forested Illinois River corridor (Hicks et al. 2011). This suggests that during spring migration Indiana bats may follow watershed drainage corridors enroute to their summer habitats in Illinois. Because Indiana bats and northern long-eared bats share hibernacula and have many overlapping summer habitats in Illinois, it is logical to infer that northern long-eared bats may have similar spring migration patterns. However, no direct spring migration route data from Illinois exists for the northern long-eared bat, at present.

Fall migration routes or patterns for both species are currently unknown. The recent discovery of four Indiana bat and five northern long-eared bat carcasses at various wind facilities in Illinois, Indiana, Iowa, Missouri, and Ohio in the fall demonstrates that some individuals cross open, treeless landscapes during their fall migration. Additionally, a 2014 fall migration telemetry study conducted on a population of Indiana bats and northern long-eared bats living in the Middle Fork of the Vermillion River riparian corridor showed that most tagged individuals did not appear to follow the river corridor when the maternity colonies broke up, but rather headed northeast across the open landscape (Boyles and McGuire, personal communication unpublished report). If other bats from other maternity colonies have the same tendency to cross open landscapes during fall migration, some level of mortality risk during fall migration is likely associated with wind turbines in the region. This risk is difficult to quantify with currently available data. The Service continues to engage with our partners to gather information to inform this risk.

Indiana Bat Swarming and Hibernation

Indiana bats begin leaving their summer range in early August for their hibernacula (Humphrey et al. 1977, Kurta et al. 1993). Some Indiana bats may stay near their summer ranges into early October (Kurta and Rice 2002). Members of a maternity colony may not hibernate in the same cave, and may migrate to caves that are over 190 miles (300 km) apart (Kurta and Murray 2002).

Upon arrival at hibernating caves in August-September, Indiana bats swarm, during which large numbers of bats fly in and out of cave entrances from dusk to dawn, with relatively few roosting in the caves during the day (Cope and Humphrey 1977). Swarming continues for several weeks and mating occurs during the latter part of the period. Fat supplies are replenished as the bats forage prior to hibernation. With the exception of the proximity to the hibernacula, swarming habitat is essentially the same as summer habitat (see description below). During fall swarming, Indiana bats roost in standing dead trees and live hickories (Kiser and Elliot 1996). In Kentucky, Kiser and Elliot (1996) found that Indiana bats foraged in upland communities. They postulated that the temperatures within the stream corridors and riparian vegetation during the autumn were too cool, which could impact the activity and density of insects in riparian areas. Insect abundance and activity may be greater in the uplands where temperatures are generally warmer. Roost switching is common during swarming (Kiser and Elliot 1996, MacGregor et al. 1999, Gumbert et al. 2002).

Generally, Indiana bats hibernate from October through April (Hall 1962, LaVal and LaVal 1980), depending upon local weather conditions. They hibernate in large, dense clusters, ranging from 300 bats per square foot to 484 bats per square foot (Clawson et al. 1980, Clawson, pers. observ. October 1996 in USFWS 2000). Also, Indiana bats tend to hibernate in caves with large volume and structural diversity that ensures stable internal temperatures, with little likelihood of freezing (Tuttle and Kennedy 2002). These caves or mines typically have two or more entrances that have a chimney effect on air flow. Tuttle and Kennedy (2002) found that populations occupying roosts with midwinter temperatures of 3.0 – 7.2° C increased in number over the past 20 years, but those with temperatures outside of this range decreased in population size. Consistent with these ranges, preliminary data from a study being conducted by Dzurick and Tomasi (2005) suggest that the optimal hibernation temperature is approximately 5°C.

Northern long-eared bat Swarming and Hibernation

The northern long-eared bat is not considered a long-distance migratory species. Researchers have documented short regional migratory movements between seasonal habitats (summer roosts and winter hibernacula) of between 56 km (35 mi) and 89 km (55 mi) (Nagorsen and Brigham 1993; Griffin 1940b; Caire et al. 1979). The spring migration period typically runs from mid-March to mid-May (Caire et al. 1979; Easterla 1968; Whitaker and Mumford 2009); fall migration typically occurs between mid-August and mid-October. The final listing rule for the northern long-eared bat identifies the active season for the species between spring and fall migration as approximately April –October. For purposes of this BO, we use April 1 – October 31 as the northern long-eared bat active season within the Action Area.

Northern long-eared bats occupy their summer habitat from approximately April through August and then begin to swarm near their hibernacula in August or September (Caire et al. 1979), depending on the geographical region. In Indiana, the majority of northern long-eared bats in Copperhead Cave have been observed to enter hibernation during October, and emerge from about the second week of March to mid-April (Whitaker and Mumford 2009). Hibernation periods farther north may begin earlier and last longer (Stones and Fritz 1969; Fitch and Shump 1979). The northern long-eared bat has been observed sharing hibernacula with other bat species (Whitaker and Mumford 2009), but is rarely observed in concentrations over 100 in a single hibernaculum (Barbour and Davis 1969). Northern long-eared bat individuals also rouse and may switch hibernacula throughout the winter, which makes it difficult to accurately estimate winter population numbers (Griffin 1940; Whitaker and Rissler 1992b; Caceres and Barclay 2000).

Northern long-eared bats predominantly overwinter in caves and abandoned mines. These hibernacula have relatively constant, cool temperatures (0 to 9 degrees Celsius (°C) (32 to 48 degrees Fahrenheit (°F))) (Raesly and Gates 1987; Caceres and Pybus 1997; Brack 2007), with high humidity and no air currents (Fitch and Shump 1979; van Zyll de Jong 1985; Raesly and Gates 1987; Caceres and Pybus 1997). The species appears to favor sites with very high humidity, such that droplets of water are often observed on their fur (Hitchcock 1949; Barbour and Davis 1969). Northern long-eared bats are typically found roosting in small crevices or cracks in cave or mine walls or ceilings, sometimes with only the nose and ears visible, which reduces the likelihood of detection during surveys (Griffin 1940a; Barbour and Davis 1969; Caire et al. 1979; van Zyll de Jong 1985; Caceres and Pybus 1997; Whitaker and Mumford 2009). Caire et al. (1979) and Whitaker and Mumford (2009) commonly observed individuals exiting caves with mud and clay on their fur, also suggesting that they had roosted in cracks and crevices.

Griffin (1945) found northern long-eared bats in December in Massachusetts in a dry well, and commented that these bats may regularly hibernate in "unsuspected retreats" where caves or mines are not available. Northern long-eared bats have been found hibernating in other types of habitat that resemble caves or mines, including:

- abandoned railroad tunnels (Service 2015, unpublished data cited in final listing rule);
- near the entrance of a storm sewer in central Minnesota (Goehring 1954);
- the facilities of a hydroelectric dam in Michigan (Kurta et al. 1997); and
- the Sudbury Aqueduct (Massachusetts Department of Fish and Game 2012, unpublished data cited in final listing rule).

2.5 Distribution and Abundance

Indiana Bat

The historical summer range of the Indiana bat is thought to be similar to its modern range. However, in various places throughout its range the bat has been locally extirpated due to fragmentation and loss of summer habitat. The current species range includes much of the eastern half of the United States, from Oklahoma, Iowa, and Wisconsin east to Vermont, and south to northwestern Florida.

Based on censuses taken at all hibernacula, the total known Indiana bat population is estimated to number about 534,239 bats (Figure 4). Population trend data have shown a relatively stable population from 2005 to present. However, with the advent of white-nose syndrome (WNS), future population trends are uncertain.

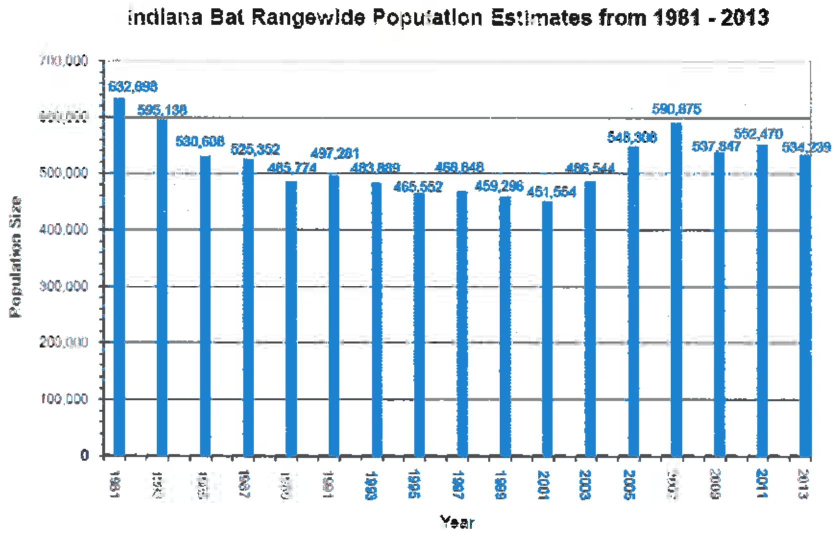

Figure 4. Indiana bat rangewide population estimates from (http://www.fws.gov/midwest/Endangered/mammals/inba/index.html).

Northern long-eared bat

The northern long-eared bat is a wide-ranging North American species that is considered to be present in all Canadian provinces, the southern Yukon Territory and eastern British Columbia (Nagorsen and Brigham 1993, and Caceres and Pybus 1997). In the United States, the bat can be found in 39 states (including the District of Columbia) from Maine to Montana, south to Kansas and eastern Oklahoma, and southeast to the Florida panhandle (Whitaker and Hamilton 1998; Caceres and Barclay 2000; Amelon and Burhans 2006).

While the species is wide ranging, it appears to be unevenly distributed, and found in low numbers in both roosts and hibernacula (Amelon and Burhans 2006; Whitaker and Hamilton, 1998). However, populations are generally categorized into the Eastern Population, the Midwest Population, the Southern Population, the Western Population, and the Canada Population, although these will not be considered to be Distinct Population Segments under Endangered Species Act (ESA) (USFWS 2013b). Historically, the species was most frequently observed in the northeastern United States and in the Canadian Provinces of Quebec and Ontario, with sightings increasing during swarming and hibernation periods (Caceres and Barclay 2000). Much of the available data on northern long-eared bats are from winter surveys, although they are typically observed in low numbers due to an apparent preference for inconspicuous roosts (Caceres and Pybus 1997). More than 1,100 northern long-eared bat hibernacula have been identified in 29 of 37 states of the species' range in the United States (80 FR 17976), although only a few (1 to 3) individuals were observed in many of these (Whitaker and Hamilton 1998).

Abundance and relative abundance (i.e., numbers of the species as a percentage of the total number of bats in an area) of the species varies substantially across its large range, and has declined dramatically with the spread of WNS. The final listing rule summarizes the abundance data available for each major region within the range, along with a range wide population estimate of 6.5 million adults (USFWS 2016).

2.6 Status

Indiana Bat

The Indiana bat (*Myotis sodalis*) was listed as an endangered species via notice in the Federal Register on March 11, 1967 (32 Fed. Reg. 48) under the Endangered Species Preservation Act of October 15, 1966 (80 Stat. 926; 16 U. S. C. 668aa(c)). The reasons for listing the species are summarized in the 2007 Draft Recovery Plan and include destruction/degradation of hibernation habitat, loss/degradation of summer habitat, migration habitat, and swarming habitat, disturbance of hibernating bats, disturbance of summering bats, disease and parasites, predation, and various anthropogenic factors (USFWS 2007).

Northern long-eared bat

The northern long-eared bat was proposed for listing as endangered on October 2, 2013, via a notice in the Federal Register (78 Fed. Reg. 191) and was formally listed as threatened on April 2, 2015. The final 4(d) rule determined that the conservation of the northern long-eared bat as a threatened species is best served by limiting the full suite of prohibitions applicable to endangered species under section 9 of the Act to its most vulnerable life stages. Furthermore, adverse effects from timber harvest, prescribed fire, forest conversion, wind energy, and other activities will not cause population-level declines in this species (USFWS 2016).

The Service concluded that white-nose syndrome (WNS) is the primary factor affecting the status of the northern long-eared bat, which has caused dramatic and rapid declines in abundance, resulting in the local extirpation of the species in some areas. Even if all anthropogenic activities that might adversely affect northern long-eared bat ceased, the Service does not believe that the resulting reduction in adverse effects would materially change the devastating impact WNS has had, and will continue to have, on northern long-eared bat at the local population level or at larger scales (USFWS 2016).

2.7 Threats and Reasons for Decline

Indiana bat

Not all of the causes of Indiana bat population declines have been determined. Although several known human-related factors have caused declines in the past, they may not solely be responsible for recent declines.

Documented causes of Indiana bat population decline include:

Disturbance and vandalism. A serious cause of Indiana bat decline has been human disturbance of hibernating bats during the decades of the 1960s through the 1980s. Bats enter hibernation with only enough fat reserves to last until spring. When a bat is aroused, as much as 68 days of fat supply is used in a single disturbance (Thomas et al. 1990). Human use (e.g., including recreational cavers and researchers) near hibernating Indiana bats can cause arousal (Humphrey 1978, Thomas 1995, Johnson et al. 1998). If this happens too often, the bats' fat reserves may be exhausted before the species is able to forage in the spring.

Active programs by State and Federal agencies have led to the acquisition and protection of a number of Indiana bat hibernacula. Of 127 caves/mines with populations >100 bats, 54 (43%) are in public ownership or control, and most of the 46 (36%) that are gated or fenced are on public land. Although such conservation efforts have been successful in protecting Indiana bats from human disturbance, they have not been sufficient to reverse the downward trend in many populations.

Improper cave gates and structures. Some hibernacula have been rendered unavailable to Indiana bats by the erection of solid gates in the entrances (Humphrey 1978). Since the 1950's, the exclusion of Indiana bats from caves and changes in air flow are the major cause of loss in Kentucky (an estimated 200,000 bats at three caves) (USFWS 1999). Other cave gates have so modified the climate of hibernacula that Indiana bats were unable to survive the winter because changes in air flow elevated temperatures which caused an increase in metabolic rate and a premature exhaustion of fat reserves (Richter et al. 1993).

Natural hazards. Indiana bats are subject to a number of natural hazards. River flooding in Bat Cave, Mammoth Cave National Park, drowned large numbers of Indiana bats (Hall 1962). Other cases of hibernacula being flooded have been recorded by Hall (1962), DeBlase et al. (1965), and the Service (1999). A case of internal cave flooding occurred when tree slash and debris (produced by forest clearing to convert the land to pasture) were bulldozed into a sinkhole, blocking the cave's rain water outlet and drowning an estimated 150 Indiana bats (USFWS 1999).

Another hazard exists because Indiana bats hibernate in cool portions of caves that tend to be near entrances, or where cold air is trapped. Some bats may freeze to death during severe winters (Humphrey 1978, Richter et al. 1993). Indiana bats are vulnerable to the effects of severe weather when roosting under exfoliating bark during summer. For example, a maternity colony was displaced when strong winds and hail produced by a thunderstorm stripped the bark from their cottonwood roost and the bats were forced to move to another roost (USFWS 1999).

Suspected causes of Indiana bat decline include:

Microclimate effects. Changes in the microclimates of caves and mines may have contributed more to the decline in population levels of the Indiana bat than previously estimated (Tuttle, in lit. August 4, 1998). Entrances and internal passages essential to air flow may become larger, smaller, or close altogether, with concomitant increases or decreases in air flow. Blockage of entry points, even those too small to be recognized, can be extremely important in hibernacula

that require chimney-effect air flow to function. As suggested by Richter et al. (1993) and Tuttle (in lit. August 4, 1998), changes in air flow can elevate temperatures which can cause an increase in metabolic rate and a premature exhaustion of fat reserves.

Land use practices. The Indiana bats' maternity range has changed dramatically since pre-settlement times (Giessman et al. 1986; MacCleery 1992; Nigh et al. 1992). Most of the forest in the upper Midwest has been fragmented, fire has been suppressed, and native prairies have been converted to agricultural crops or to pasture and hay meadows for livestock. Native plant species have been replaced with exotics in large portions of the maternity range, and plant communities have become less diverse than occurred prior to settlement. Additionally, numerous chemicals are applied to these intensely cropped areas. The changes in the landscape and the use of chemicals (McFarland 1998) may have reduced the availability and abundance of the bats' insect forage base. In the eastern U.S., the area of land covered by forest has been increasing in recent years (MacCleery 1992; Iverson 1994; Crocker et al. 2006). Whether or not this is beneficial to the Indiana bat is unknown. The age, composition, and size class distribution of the woodlands will have a bearing on their suitability as roosting and foraging habitat for the species outside the winter hibernation season.

Chemical contamination.

Pesticides have been implicated in the decline of a number of insectivorous bats in North America (Mohr 1972, Reidinger 1972, Reidinger 1976, Clark and Prouty 1976, Clark et al. 1978, Geluso et al. 1976, Clark 1981). The effects of pesticides on Indiana bats have yet to be studied. McFarland (1998) studied two sympatric species; the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*M. septentrionalis keenii*) as surrogates in northern Missouri and documented depressed levels of acetylcholinesterase, suggesting that bats there may be exposed to sublethal levels of organophosphate and/or carbamate insecticides applied to agricultural crops. McFarland (1998) also demonstrated that bats in northern Missouri are exposed to significant amounts of agricultural chemicals, especially those applied to corn. BHE Environmental, Inc. (1999) collected tissue and guano samples from five species of bats at Fort Leonard Wood, Missouri, and documented the exposure of bats to p,p'-DDE, heptachlor epoxide, and dieldrin.

New Threats/Disease epidemics: WNS:

WNS was first documented in New York in February of 2006 and has since been observed to have spread west to Iowa and Missouri,(www.nwhc.usgs.gov). It is currently unknown if WNS is the primary cause or a secondary indicator of another pathogen, but it has been correlated with erratic behavior such as early or mid-hibernation arousal that leads to emaciation and mortality in several species of bats, including the Indiana bat (www.fws.gov). Additional information on the effects of WNS is presented below.

Northern long-eared bat

The Northern long-eared bat has been listed as threatened based on the severity of population impacts that have been realized in areas with WNS, and the expected population impacts that will likely occur with the spread of the disease in the future.

White-nose syndrome

WNS is an emerging infectious wildlife disease caused by a fungus of European origin, *Pseudogymnoascus destructans*, which poses a considerable threat to hibernating bat species throughout North America, including the northern long-eared bat (Service 2011). WNS is responsible for unprecedented mortality of insectivorous bats in eastern North America (Blehert et al. 2009;Turner et al. 2011). The first evidence of the disease (a photo of bats with fungus) was documented near Albany, New York, on February 16, 2006, but WNS was not actually discovered until January 2007, when it was found at four additional caves in the same vicinity (Blehert et al. 2009). Since that time, WNS has spread rapidly throughout the eastern portions of the northern long-eared bats range in the U.S. and Canada. As of February 2015, WNS was confirmed in 25 of the 37 U.S. States within the species' range and in 5 Canadian provinces (80 FR 18000). Spores of the fungus disperse to new locations primarily through bat-to-bat contact (Kunz and Reichard 2010); however, evidence suggests that humans may also transport spores between locations (USGS National Wildlife Health Center 2014), which is likely how the fungus arrived in North America.

Post-WNS hibernacula counts available from the northeast U.S., where the epizoitic began, show the most substantial population declines for the northern long-eared bat. Turner et al. (2011) compared the most recent pre-WNS count to the most recent post-WNS count for six cave bat species and reported a 98 percent total decline in the number of hibernating northern long-eared bats at 30 hibernacula in New York, Pennsylvania, Vermont, Virginia, and West Virginia through 2011. For the final listing rule, the Service conducted an analysis of additional survey information at 103 sites across 12 U.S. States and Canadian provinces (New York, Pennsylvania, Vermont, West Virginia, Virginia, New Hampshire, Maryland, Connecticut, Massachusetts, North Carolina, New Jersey, and Quebec) and found comparable declines in winter colony size. At these sites, total northern long-eared counts declined by an average of 96 percent after the arrival of WNS; 68 percent of the sites declined to zero northern long-eared bat, and 92 percent of sites declined by more than 50 percent. Frick et al. (2015) consider the northern long-eared bat now extirpated from 69 percent of the hibernacula in Vermont, New York, Pennsylvania, Maryland, Virginia, and West Virginia that had colonies of northern long-eared bats prior to WNS. Langwig et al. (2012) reported that 14 populations of northern long-eared bats in New York, Vermont, and Connecticut became locally extinct within 2 years due to disease.

Long-term summer survey data (including pre- and post-WNS) for the northern long-eared bat, where available, corroborate the population decline evident in hibernacula survey data. For example, summer surveys from 2005 – 2011 near Surry Mountain Lake in New Hampshire showed a 98 percent decline in capture success of northern long-eared bats post-WNS, which is similar to the hibernacula data for the State (a 95 percent decline) (Moosman et al. 2013). Other data, much of it received as comments on the proposed listing rule from State wildlife agencies, demonstrate that various measures of summer northern long-eared bat abundance and relative abundance (mist net surveys, acoustic surveys) have declined following detection of WNS in the state.

Although the dispersal rate of *P. destructans* across the landscape and the onset of WNS after the fungus arrives at a new site are variable, it appears unlikely that any site within the range of the northern long-eared is not susceptible to WNS. Some evidence suggests that certain microclimatic conditions may hinder disease progression at some sites, but given sufficient exposure time, WNS has had similar impacts on northern long-eared bat everywhere the disease is documented. Absent direct evidence that some northern long-eared bats exposed to the fungus do not contract WNS, available information suggests that the disease will eventually spread throughout the species' range.

Other Threats

The final listing rule for the northern long-eared bat describes known threats to the species under each of the five statutory factors for listing decisions, of which disease/predation, discussed above, is the dominant factor. We summarize here the findings of the final listing rule regarding the other four factors that are relevant to this consultation.

Human and non-human modification of hibernacula, particularly altering or closing hibernacula entrances, is considered the next greatest threat after WNS to the northern long-eared bat. Some modifications, e.g., closure of a cave entrance with structures/materials besides a bat-friendly gate, can cause a partial or complete loss of the utility of a site to serve as hibernaculum. Humans can also disturb hibernating bats, either directly or indirectly, resulting in an increase in energy-consuming arousal bouts during hibernation (Thomas 1995; Johnson et al. 1998).

During the summer, northern long-eared bat habitat loss is primarily due to forest conversion, and to a lesser degree, unsustainable forest management. Throughout the range of northern long-eared bat, forest conversion is expected to increase due to commercial and urban development, energy production and transmission, and natural changes. Forest conversion causes loss of potential habitat, fragmentation of remaining habitat, and if occupied at the time of the conversion, direct injury or mortality to individuals. Forest management activities, unlike forest conversion, typically result in temporary impacts to the habitat of northern long-eared bats, but like forest conversion, may also cause direct injury or mortality to individuals. The net effect of forest management may be positive, neutral, or negative, depending on the type, scale, and timing of various practices. The primary potential benefit of forest management to the species is perpetuating forests on the landscape that provide suitable roosting and foraging habitat. The primary potential impacts of forest management are greatly reduced with the use of various measures that avoid or minimize effects to bats and their habitat, e.g., limiting the size of clearcuts, avoiding or minimizing timber harvest during the flightless period for bat pups, leaving sufficient numbers of snags and other trees suitable as roosts following harvests, etc.

Wind energy facilities are known to cause northern long-eared bat mortality. While mortality estimates vary between sites and years, sustained mortality at particular facilities could cause declines in local populations. Wind energy development within portions of the species' range is projected to continue.

Climate change may also affect this species, as northern long-eared bats are particularly sensitive to changes in temperature, humidity, and precipitation. Climate change may indirectly affect the northern long-eared bat through changes in food availability and the timing of hibernation and reproductive cycles. Environmental contaminants, in particular insecticides, other pesticides, and inorganic contaminants, such as mercury and lead, may also have detrimental effects on northern long-eared bats. Contaminants may bio-accumulate (become concentrated) in the tissues of bats, potentially leading to a myriad of sub-lethal and lethal effects.

Fire is one of the environmental stressors that contribute to the creation of snags and damaged trees on the landscape, which northern long-eared bats frequently use as summer roosts. Fire may also kill or injure bats, especially flightless pups. Prescribed burning is a common tool for forest management in many parts of the species' range.

There is currently no evidence that the natural or manmade factors discussed above (hibernacula modification, forest conversion, forest management, wind energy, climate change, contaminants, fire) were separately or cumulatively contributing to significant range-wide population effects on the northern long-eared bat prior to the onset of WNS.

2.8 Collisions with Wind Turbines

To-date, 10 Indiana bat fatalities have been documented at wind facilities throughout the range of the species. Seven of these fatality events occurred in the fall, one occurred in the spring, and two occurred in July. Over 45 northern long-eared bat fatalities have been reported in publically-available literature from several eastern and Midwestern states, as well as Canada. This information, combined with information that suggests bat fatalities of several other species are ubiquitous at wind facilities, indicates that operating wind turbines pose some lethal risk to both species across their ranges. It should also be noted that four take permits have been issued to wind facilities in Region 3. The Fowler Ridge Wind Farm in northwestern Indiana is currently authorized to take 184 Indiana bats over the project's permitted life (2014-2035), which is approximately nine bats per year. The Pioneer Trail Wind Farm Project in east central Illinois has been authorized to take 129 Indiana bats and 86 northern long-eared bats over a 43 year permit term. A take permit also has been issued to the Buckeye Wind Project in Ohio for the taking of up to 130 Indiana bats over a 25-year permit term, but this facility is not yet operational. The most recent permit issued to a wind energy facility was to the Wildcat Wind Farm in Indiana to authorize the taking of up to 162 Indiana bats and 81 northern long-eared bats during the 28-year permit term.

There are four operational wind farms in the vicinity of the action area; two of these farms have been issued 10(a)1(B) permits, one farm is operating under a TAL, and the fourth is not operating under either a TAL or a permit.

3. Environmental Baseline

The purpose of the environmental baseline is to describe past and ongoing human and natural factors that have contributed to the current status of the species and its habitat in the project action area. Range-wide factors affecting the species include those listed previously under Reasons for Decline.

3.1 Status of the Indiana Bat and Northern long-eared bat within the Action Area

Roughly, 95 percent of the Project Area is used for production of cultivated crops. The remaining 5 percent of the Project Area is developed. Deciduous forest makes up less than 0.1 percent of the Project Area. Forested areas are small, linear patches of forest or are associated with larger streams (IGD 2000 as cited in the Project HCP). The only water resources in the Project Area are Bluegrass Creek tributary and small, unnamed tributaries associated with the North Fork Vermillion River (Project BBCS).

Indiana bat maternity colonies are known to occur in Vermilion County and summer records are known from adjacent Ford County (USFWS 2007). In July 2010, an Indiana bat maternity colony was found near the Middle Fork of the Vermilion River in Ford and Champaign counties (K. Shank, ILDNR, personal communication), 10 miles from the Project Area. Illinois has 22 known hibernacula, and of these, 16 sites have had at least one bat since 1995 (USFWS 2007). No known hibernacula occur in the Project Area or Vermilion County (USFWS 2007). Blackball Mine located in LaSalle County is the closest known hibernaculum to the Project (USFWS 2007), approximately 130 miles to the northwest of the site. This hibernaculum is considered a Priority 2 site containing a population of 1,804 Indiana bats, and is the only designated critical habitat in Illinois.

Boyles and McGuire (2014) conducted a telemetry study of Indiana bats and northern long-eared bats captured at the Middle Fork Forest Preserve, approximately 6 miles west of the Project. The surveyors installed a receiving antenna array and datalogger at the Project site to detect movement of the radio-tagged bats. Additional receiving arrays with dataloggers were installed at 6 other locations in the region. The team captured 26 bats representing 5 species from August 8–24, 2015. They outfitted 8 bats (3 northern long-eared bats and 5 Indiana bats) with transmitters. The datalogger within the Project Area did not detect any bats with transmitters. Initial results suggested that Indiana bats departed the study site in a northeast direction (away from the project area).

3.2 Factors Affecting the Indiana Bat Environment within and adjacent to the Action Area

The action area is expected to continue to produce agricultural crops as normal, and no major land use changes are expected during the term of the action. Some agricultural crops may need to be cleared around turbines to facilitate mortality searches, but it is not expected that this will impact the foraging of Indiana bats or northern long-eared bats. No commercial development that will greatly alter bat habitat in or adjacent to the action area is expected, as these communities are agricultural based. No Federal actions that would affect the Indiana bat in the immediate vicinity of the area are known to be proposed at the time of this Biological Opinion.

4. Effects of the Action

"Effects of the action" refers to the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated and or interdependent with that action which will be added to the environmental baseline. The Act defines direct effects as those considered immediate effects of the project on the species or its habitat. Indirect effects are those caused by the proposed action that are later in time, but are still reasonably certain to occur (50 CFR §402.02). Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consultation. This section includes an analysis of the direct and indirect effects of the proposed action and associated interrelated and interdependent activities on the Indiana bat and its potential and critical habitat.

As a result of the operation of the wind turbines, collisions with turbine blades and/or barotrauma are likely to be the primary cause of take of both species. Compensatory mitigation for take will be implemented as part of the HCP and will have long-term benefits, but may involve short-term harassment. Specifically, if colonies of Indiana bats or northern long-eared bats are within the vicinity of areas where tree planting or thinning will occur, these actions may disturb or temporarily displace them or alter their behavior slightly. This action is not expected to directly kill any Indiana bats, however. Therefore, the lethal take of turbine operation is the focus of the analysis below. Moreover, the effects of this lethal take are analyzed sequentially at the local colony scale, hibernacula, Recovery Unit, and the species range wide level.

4.1 Direct Effects of Federally Permitted Actions

As presented in Section 6.4.2.3 of the HCP, the applicant has estimated that the project will involve lethal take of up to 2 Indiana bats and 2 northern long-eared bats over the 30-year permitted life of the project. Additionally, the Applicant expects that take will occur in the fall primarily.

Due to natural variability in any biological system, it is expected that bat migration patterns and associated collision risk may vary from year to year. To address this uncertainty and help guard against exceedance of permitted take, the applicant has committed to ongoing mortality monitoring and will be implementing an adaptive management regime. If the estimated take rate of Indiana bats exceeds two over any three year period and the projected take rate (based on monitoring to date) indicates that the permit will be exceeded, adaptive management will be implemented to reduce the take rate and increased monitoring will be done to inform the effectiveness of the adaptive management. As long as the 4(d) rule for northern long-eared bats is in effect, the adaptive management for this species will be triggered at an average rate of 4 bats per year. If the exemptions under the 4(d) rule are removed, adaptive management will be triggered at an annual average rate of 2 per year. (See section 8.1.2.5 of the HCP.)

Because mature male Indiana bats are expected to stay near hibernacula and not be long-distance migrants, we expect fall migrating Indiana bats crossing the project area are most likely to be made up of female bats and their offspring. This means that approximately 75 percent of the 60 migrating bats will be female, and the number of female Indiana bat mortalities per year would be 1.50. Given that a fraction of a bat cannot be taken, we consider that three female Indiana bats would be taken every two years.

Regarding northern long-eared bats, it is estimated in Section 6.4.3.1 of the HCP that the sex ratio of northern long-eared bats migrating through the project area is expected to be approximately 1:1. Therefore, it can be reasonably expected that 1 female northern long eared bat will be taken each year, with 30 taken over the life of the project. These ratios inform our effects analysis in section 6.2, below.

4.2 Interrelated Activities, Interdependent Activities, and Indirect Effects

The project proponent has proposed to conduct mitigation to offset the impact of the requested take. The mitigation actions are considered interrelated activities, as they would not occur but for the project. The applicant has committed to restoring and/or enhancing at least 165 acres of bat habitat. Within 5 months of permit issuance, the applicant will provide to the Service a specific mitigation plan, which will be approved by the Service prior to implementation.

The Service's REA model (Version 3.0, March 29, 2014) was used to determine the quantity of summer habitat mitigation to fully offset the proposed taking. The REA model indicated that 150 acres of mitigation was needed to fully offset the taking of either species. The applicant is proposing to stack mitigation credits onto the mitigation parcel because the species are expected to realize ecological benefits from the mitigation lands. Because some competition may occur between the species, the applicant has agreed to add an additional 15 acres (10%) of mitigation. The proposed mitigation will be selected based on the suitability of existing and adjacent habitat for the covered species, and the proximity to existing populations of northern long-eared bats and Indiana bats. Summer habitat mitigation will consist of, but is not limited to, tree plantings, mowing around trees to reduce competition and impede weed growth, stand thinning, girdling to provide roost trees, understory plantings, invasive species control, prescribed fire, selective harvesting, and/or supplemental plantings. These mitigation strategies are expected to increase the quality and carrying capacity of existing bat habitat. See section 7.2.2 and Appendix B of the HCP.

5. Cumulative Effects

Cumulative effects include the effects of State, local or private actions that may occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. The Service is unaware of any other Federal or non-Federal actions that are reasonably certain to occur which may adversely affect the Indiana bat or northern long-eared bat in the project action area. The action area is located in a landscape that is predominantly agricultural. Many of the core forested areas that provide suitable habitat for the northern long-eared bat and Indiana bat in the nearby corridor of the Middle Fork of the Vermilion River are owned by the Champaign County Forest Preserve District. Other core forested areas are privately owned, but are largely located along streams and other waterways which do not lend themselves to easy clearing or land use conversion. Tree clearing (summer habitat alteration) could occur on privately owned tracts. However, the amount and intensity of these actions on private land in the action area are not expected to change the scope or magnitude of effects anticipated from this project.

One other wind project, the Pioneer Trail Wind Farm, is located approximately 7 miles to the northwest of the Hoopeston project area. This project is permitted to take three Indiana bats and two northern long eared bats per year for the remainder of their permit term (42 years). It is plausible that the Indiana bats and northern long-eared bats that fly through the two project areas may come from the same regional populations. The migration study conducted in conjunction with the development of the Hoopeston project indicated that tagged bats from the closest maternity colonies (on the Middle Fork Forest Preserve) flew in a northeasterly direction, not through the Hoopeston project area. It is unknown whether or not these colonies supply bats that fly through either or both of the project areas. It is plausible, however that bats flying through one or both of the project areas come from the same hibernacula (i.e. Rays Cave and Blackball Mine). This means that a cumulative take of five Indiana and four northern long-eared bats are or would be permitted to be taken annually from populations flying through this area of Illinois.

Based on the above, the cumulative level of effects anticipated from these activities, combined with the project effects, is not anticipated to have measurable changes to Indiana bat and northern long-eared bat populations or habitat within the action area or the Ozark Central and Midwest Recovery Units.

6. Conclusion

After reviewing the current status of the Indiana bat and northern long-eared bat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects as described above, it is the Service's biological opinion that the proposed project, interdependent, and interrelated actions are not likely to jeopardize the continued existence of the Indiana bat or the northern long-eared. There is no critical habitat for the Indiana bat in the project action area, and therefore, destruction or adverse modification of critical habitat as a result of the project is not expected.

7. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA, prohibits the take of endangered and threatened species without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

7.1 Extent of Take Anticipated

In conjunction with the project, no more than 60 Indiana bats and 60 northern long-eared bats will be taken over the 30-year life of the project and permit. This take is expected to be distributed evenly across the permit period, with approximately two Indiana bats and two northern long-eared bats taken each year. Due to environmental stochasticity, this number may vary a from year to year.

On January 14, 2016 the Service published final species specific rule pursuant to section 4(d) of the ESA for the northern long-eared bat (81 FR 1900). The 4(d) rule exempts the take of northern long-eared bats from the Section 9 prohibitions of the ESA (except in certain circumstances) including any incidental take that occurs while operating wind turbines. The incidental take that is carried out in compliance with the 4(d) rule does not require exemption in this Incidental Take Statement.

Take coverage for the Indiana bat will begin on the effective date (expected to before spring migration in 2018) listed on the Section 10(a)(1)(B) permit and extend through the end of 2048. In the event that the 4(d) rule is rescinded or the northern long-eared bat is listed as endangered and incidental take is no longer exempted as described in the 4(d) rule, take coverage will begin 30 days after a final listing rule is published. Monitoring and adaptive management (as outlined in the HCP) will be implemented to ensure that this take number is not exceeded for either species.

7.2 Effect of the Take

Effect of the take on Indiana bats at the local population level

In order to understand how take could be distributed at the local maternity colony level, the Service used the WEST Migration Model (Nations and Young, 2015) to estimate the number of maternity colonies that may contribute to bats flying through the project area (a summary of the migration model methods, model assumptions, and outputs are on file at the Illinois-Iowa Ecological Services Field Office). The model analyzes the potential location of maternity colonies in suitable habitat on the landscape, overlays the known hibernacula, and simulates trajectories of bats between hibernacula and modelled maternity colony locations. For this project, we assumed an open boundary between the Ozark Central Recovery Unit (OCRU) and the Midwest Recovery Unit (MWRU) because the project is on the border of the two RU's and northern long-eared bats and Indiana bats migrating through the project area could reasonably be expected from either.

The model generated the number of maternity colonies that may contribute to bats fly through the project area depending on simulated migration path widths. Specifically, the model outputs indicated that the number of maternity colonies with bats that cross the Hoopeston project area could be 16 (5 km migration path width), 20 (10 km migration path width), 27 (15 km path width), and 32 (20 km migration path width). These numbers assume that bats from each modelled maternity colony on the landscape only fly to a maximum of 10 hibernacula (modelled based on proximity of hibernacula to maternity colony).

To understand the effect of the take at the maternity colony level, we used the Thogmartin demographic model (BatTool version 5.3) to explore the main question of whether or not incidental take associated with the project appreciably changes the probability of extinction of these colonies. Because the bats passing through the area are migrating bats, we assumed that take was evenly distributed among at least 16 maternity colonies. The model inputs are measured in female Indiana bats only. Given the 3:1 ratio of females and males explained above, there would be 1.5 female bats distributed among these maternity colonies per year. However, fractions of bats cannot be taken, so over the 30 year period, this translates (rounds up) to three females from each colony if there are 16 or 20 colonies crossing the project area. This also translates to two females from each colony over 30 years if there are 27 or 32 colonies contributing bats to the area. Therefore, the model analyzed a single maternity colony three times. The first analysis was a no take scenario. The second was a take of three bats in 50 years (duration is a fixed parameter in the model) to simulate bats coming from 16 or 20 colonies. And the third was a take of two bats in 50 years to simulate bats coming from 27 or 32 colonies. Because white nose syndrome has begun to show effects in the MWRU and parts of the OCRU, we used the model to analyze with WNS impacts beginning in 2019.

Under a no-take scenario (without project take), the probability of extinction of the modeled maternity colony was 59.3%. Under the take scenarios, the probability of extinction of the modeled maternity colony in 50 years with a take of two and three bats was 64.02% and 65.03%, respectively.

Effect of the take on Indiana bats at the hibernacula population level

We also modelled the effect of the project on hibernacula populations in the OCRU and MWRU. The WEST migration model, under the restricted scenario mentioned above, indicated that up to 32 hibernacula could contribute one or more bats that fly through the project area. Of these, we chose to analyze the effects of the project on the closest hibernacula to the project area, Ray's Cave, with a population of 24,809 female Indiana bats. Using the Thogmartin model we analyzed the scenarios with a stable lambda (populations were assumed to be stable), and WNS effects began in 2019. The probability of extinction of this population without the project was 0.49% and with the project was 0.64%. It is our opinion that this difference is negligible.

Effect of the take on Indiana bats at the recovery unit and rangewide population level

Given that the effect of the take at the hibernacula level was negligible, it follows that the effect of the take at the recovery unit and rangewide level, which have much larger population sizes, is also negligible.

Effect of the take of northern long-eared bats

Although the incidental take of northern long-eared bats that is expected to occur from the activities covered by the HWP HCP is exempted by the 4(d) rule (see Summary above), the project proponent has decided to include northern long-eared bats as a covered species and estimates that take will be approximately two per year. The 4(d) rule exempts incidental take of northern long-eared bats that occurs outside of hibernacula resulting from activities other than tree removal, is not prohibited. In its January 5, 2016 biological opinion on the issuance of the 4(d) rule, the Service concluded that projects that would cause take that would be exempted under the rule would not jeopardize the northern long eared bat. We expect the issuance of the ITP to cause only take of the northern long eared bat that is exempted under the 4(d) rule. That is, it is not likely to result in any take that would be prohibited per the 4(d) rule and is also not likely to jeopardize the species. Nevertheless, the company proposes to trigger adaptive management if northern long-eared bat take exceeds an average of 4 per year, or 60 bats over the life of the permit. If, during the permit term, the exemptions under the 4(d) rule should no longer apply, the applicant will implement adaptive management that would trigger at an average of 2 northern long-eared bats taken per year. We have written the reasonable and prudent measures (see below) to apply to both covered bat species to also address this possibility and to be consistent with the adaptive management described in the HCP. Adaptive management measures are described in section 7.4 and 8.1.2.5 of the HCP, and will ensure that the permitted take does not exceed 60 individuals over the life of the permit.

Because little data exists on summer or winter colony dynamics, migration pathways, and hibernacula locations, it was not possible to model the effects of the project to this species to the degree available for Indiana bats. No firm range-wide population size estimates exist for northern long-eared bats, but the 4(d) rule indicates that there are likely more than four million bats in the Midwest (USFWS 2015). If a population dynamics model existed for northern long-eared bats, we would model the effect of four bats per year on the pre-WNS population and two bats per year on post-WNS population. Because no population model currently exists, the best available proxy is the Indiana bat analysis described above. It is appropriate to infer that effects of the take to northern long-eared bats are similar to effects on the Indiana bat because: a) the permitted take number is equal to Indiana bat take, b) reproductive rates of northern long-eared bats are likely to be comparable to Indiana bats (USFWS 2014), c) regional populations of northern long-eared bats are expected to be larger than regional Indiana bat populations, and d) the location of summer and winter habitats are expected to be similar for both species.

Given that the take scenario modelled for the Indiana bat did not show an appreciable difference in the probability of extinction, it is logical to conclude that the effect of the taking on the northern long-eared bat populations are also not appreciable.

7.3 Reasonable and Prudent Measures and Terms and Conditions

Reasonable and prudent measures (RPMs) refer to those actions the USFWS believes necessary or appropriate to minimize the impacts of the incidental take (50 CFR 402.02). The terms and conditions set out the specific methods by which the reasonable and prudent measure is to be accomplished.

The issuance criteria for a section 10(a)(1)(B) permit require that the incidental take resulting from the covered actions be minimized and mitigated to the maximum extent practicable (50 C.F.R. 17.22(b)(2)(B)). The associated ITP requires that the HCP be fully implemented. Monitoring will be conducted as stated in Section (7.3) of the HCP. Although the incidental take of the northern long eared bat that will occur as a result of the ITP's issuance is exempted currently by the 4(d) rule, the RPMs and terms and conditions described below will apply to both covered species to address the potential for the 4(d) rule to be vacated during the life of the ITP.

Reasonable and Prudent Measure and Terms and Conditions

RPM: The USFWS will ensure that all activities are completed and carried out as described in the BO, the HCP, the mitigation plan, and the ITP.

Terms and Conditions: The USFWS shall ensure that any activities that they authorize or permit are consistent with the AMMs, survey, monitoring, and reporting requirements provided in the HCP, and that any such activities otherwise provide levels of listed species protection consistent with the protection afforded under the HCP.

8. Reinitiation Notice

This concludes formal consultation on the Hoopeston Wind Energy Project and associated issuance of a Section 10(a)(1)(B) take permit. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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